CLAIMS

1. An apparatus comprising:
an endoluminal implant; and
a transducer coupled to said endoluminal implant.

2. The apparatus of claim 1 wherein said transducer comprises a therapeutic transducer.

3. The apparatus of claim 1 wherein said transducer comprises a therapeutic transducer chosen from a group comprising: an electromagnetic transducer, an optical transducer, an ultrasonic transducer, a resistive heater transducer and an iontophoretic transducer.

4. The apparatus of claim 1, further comprising a RF coupling coil having an output coupled to said transducer.

5. The apparatus of claim 4, further comprising a RF-to-DC power supply electrically coupled to said output of said RF coupling coil and having an output coupled to a signal source that is in turn coupled to said transducer, said signal source activating said transducer in response to signals from said RF coupling coil.

6. The apparatus of claim 1 wherein said endoluminal implant is chosen from a group comprising: a stent and a stent graft.

7. The apparatus of claim 2 wherein said therapeutic transducer is coupled to a saddle-shaped coil integrated into a wall of said endoluminal implant.

8. The apparatus of claim 2 wherein said therapeutic transducer is coupled to a helical coil integrated into a wall of said endoluminal implant.

9. The apparatus of claim 4 wherein:

said endoluminal implant comprises a stent; and

said RF coupling coil comprises a woven mesh of wire integrated into a wall of said stent.

10. The apparatus of claim 9 wherein said woven mesh of wire comprises:

a first set of coils of insulated wire each forming a right-handed spiral; and

a second set of coils of insulated wire each forming a left-handed spiral, said second set of coils interwoven with said first set of coils, wherein said first set of coils and said second set of coils are electrically coupled in series in a daisy-chain configuration.

11. The apparatus of claim 9 wherein said woven mesh of wire comprises:

a first set of coils of insulated wire each forming a right-handed spiral, each of said coils of said first set of coils having a first end and a second end, wherein said first ends are electrically coupled to each other and said second ends are coupled to each other; and

a second set of coils of insulated wire each forming a left-handed spiral, said first and second sets of coils interwoven with each other to form said woven mesh, each of said coils of said second set of coils having a first end and a second end, wherein said first ends of said second set of coils are electrically coupled to each other and said second ends of said second set of coils are coupled to each other, said first and second sets of coils being electrically coupled to each other and to said transducer.

12. The apparatus of claim 2 wherein said therapeutic transducer includes a regular solid comprising piezoelectric material, wherein a first resonance

frequency is determined by a first dimension of said regular solid and a second resonance frequency is determined by a second dimension of said regular solid, said regular solid including a first electrode coupled to a first surface of said regular solid and a second electrode coupled to a second surface of said regular solid.

13. The apparatus of claim 12, further comprising an acoustic isolator disposed on said first electrode and on a sidewall of said regular solid and wherein said first dimension is approximately twice said second dimension.

14. The apparatus of claim 2 wherein said therapeutic transducer comprises:

an ultrasonic transducer having an acoustic radiating surface, wherein a first electrode and a second electrode are coupled to said ultrasonic transducer, said ultrasonic transducer coupled to a first wall of said endoluminal implant; and

an acoustic reflector coupled to a second wall of said endoluminal implant, said acoustic reflector being maintained in alignment with and facing said acoustic radiating surface of said ultrasonic transducer by said endoluminal implant.

15. The apparatus of claim 14 wherein said acoustic reflector comprises a magnet.

16. The apparatus of claim 2 wherein said therapeutic transducer comprises:

a first ultrasonic transducer having an acoustic radiating surface, wherein a first electrode and a second electrode are coupled to said first ultrasonic transducer, said first ultrasonic transducer coupled to a first wall of said endoluminal implant; and

a second ultrasonic transducer having an acoustic radiating surface, wherein a first electrode and a second electrode are coupled to said second ultrasonic transducer, said second ultrasonic transducer being coupled to a second wall of said endoluminal implant such that said acoustic radiating surface of said first ultrasonic

transducer is aligned with and facing said acoustic radiating surface of said second ultrasonic transducer.

17. The apparatus of claim 2, further comprising:

a RF coupling coil integrated into a wall of said endoluminal implant;

an implantable electronic circuit, said implantable electronic circuit including a RF-to-DC power supply circuit coupled to said RF coupling coil, whereby RF energy coupled into said RF coupling coil may be converted to DC power, and whereby RF coded information may be exchanged between said RF coupling coil and said implantable electronic circuit; and

18. The apparatus of claim 17, wherein said implantable electronic circuit also includes:

RF decoding circuitry and a multiplexer, said RF decoding circuitry coupled to said RF coupling coil, whereby said multiplexer may supply signals from said implantable electronic circuit to said therapeutic transducer; and

a second transducer coupled to said endoluminal implant wherein said first and second transducers are coupled to said implantable electronic circuit and comprise ultrasonic transducers configured to provide first and second acoustic waves in a space between said first and second transducers in response to signals from said implantable electronic circuit.

19. The apparatus of claim 2, further comprising a diagnostic transducer coupled to said endoluminal implant

20. The apparatus of claim 19, wherein said diagnostic transducer provides signals indicative of a parameter describing a fluid flowing through said endoluminal implant, wherein said parameter is chosen from a list comprising: fluid flow, pressure, temperature and biochemical properties.

21. The apparatus of claim 4 wherein said therapeutic transducer includes a therapeutic transducer chosen from a group comprising: ultrasonic transducers, optical transducers, magnetic transducers, resistive heating transducers and iontophoretic transducers.

22. An apparatus comprising:

an endoluminal implant;

a RF coupling coil coupled to said endoluminal implant;

an implantable electronic circuit electrically coupled to said RF coupling coil and physically coupled to said endoluminal implant, said RF coupling coil for supplying electrical power to said implantable electronic circuit and for coupling control and data signals to and from said implantable electronic circuit; and

a therapeutic transducer electrically coupled to said implantable electronic circuit, said therapeutic transducer for delivering therapeutic energy to a lumen disposed within said endoluminal implant in response to said control signals.

23. The apparatus of claim 22 wherein said RF coupling coil is disposed on said endoluminal implant and comprises a RF coupling coil chosen from a group comprising: a saddle-shaped coil, a helical coil and a woven mesh coil.

24. The apparatus of claim 22 further comprising a diagnostic transducer coupled to said endoluminal implant, said diagnostic transducer electrically coupled to said implantable electronic circuit to provide diagnostic signals thereto.

25. The apparatus of claim 24 wherein said diagnostic transducer comprises a pressure transducer arranged to measure a pressure of a fluid in a lumen of said endoluminal implant.

26. The apparatus of claim 22 wherein said therapeutic transducer comprises means for insonifying a lumen disposed in said endoluminal implant.

27. The apparatus of claim 22 wherein said therapeutic transducer comprises means for insonifying a lumen disposed in said endoluminal implant with one or more acoustic waves.

28. The apparatus of claim 22, further comprising a diagnostic transducer coupled to said endoluminal implant, said diagnostic transducer including an electrical coupling to said implantable electronic circuit for exchanging data between said diagnostic transducer and said implantable electronic circuit.

29. The apparatus of claim 28 wherein said diagnostic transducer comprises a conformal transducer array coupled to said endoluminal implant to measure fluid velocity through a lumen extending through said endoluminal implant.

30. The apparatus of claim 28 wherein said diagnostic transducer comprises a first electrode and a second electrode, said first and second electrodes disposed in a fixed, spaced-apart relationship within a lumen of said endoluminal implant and adjacent a wall thereof, whereby capacitance or resistance measurements between said first and second electrodes characterize those bodily elements immediately surrounding said first and second electrodes.

31. The apparatus of claim 28 wherein said diagnostic transducer comprises a first pressure transducer disposed at an inlet whereby fluid enters said endoluminal implant.

32. The apparatus of claim 31 wherein said diagnostic transducer further comprises a second pressure transducer disposed at an outlet whereby fluid exits said endoluminal implant.

33. The apparatus of claim 22 wherein said therapeutic transducer includes one or more light sources.

34. The apparatus of claim 22 wherein said therapeutic transducer comprises an iontophoretic transducer.

35. The apparatus of claim 22 wherein said therapeutic transducer comprises an electromagnetic transducer.

36. The apparatus of claim 22 wherein said therapeutic transducer comprises a resistive heating transducer.

37. The apparatus of claim 22 wherein said therapeutic transducer comprises:

a first ultrasonic transducer having an acoustic radiating surface, a first electrode and a second electrode each coupled to said first ultrasonic transducer, said first ultrasonic transducer coupled to a first wall of said endoluminal implant; and

a second ultrasonic transducer having an acoustic radiating surface, a first electrode and a second electrode each coupled to said second ultrasonic transducer, said second ultrasonic transducer being coupled to a second wall of said endoluminal implant such that said acoustic radiating surface of said first ultrasonic transducer is aligned with and facing said acoustic radiating surface of said second ultrasonic transducer.

38. The apparatus of claim 22 wherein said therapeutic transducer comprises:

an ultrasonic transducer having an acoustic radiating surface, a first electrode and a second electrode each coupled to said ultrasonic transducer, said ultrasonic transducer coupled to a first wall of said endoluminal implant; and

an acoustic reflector coupled to a second wall of said endoluminal implant, said acoustic reflector being maintained in alignment with and facing said acoustic radiating surface of said ultrasonic transducer.

39. The apparatus of claim 38 wherein said acoustic reflector comprises a magnet.

40. The apparatus of claim 22 wherein said therapeutic transducer comprises an ultrasonic transducer capable of providing collinear acoustic waves at a first frequency and a second frequency.

41. An apparatus comprising:

an endoluminal implant; and

a RF coupling coil integrated in a wall of said endoluminal implant.

42. An apparatus as claimed in claim 41, wherein said RF coupling coil comprises a RF coupling coil chosen from a group comprising: a saddle coil, a helical coil and a woven mesh coil.

43. An apparatus as claimed in claim 41, further comprising a therapeutic transducer electrically coupled to said RF coupling coil.

44. An apparatus as claimed in claim 41, further comprising:

an implantable electronic circuit coupled to said RF coupling coil, said implantable electronic circuit exchanging data, power and control signals with said RF coupling coil; and

a therapeutic transducer electrically coupled to said implantable electronic circuit and mechanically coupled to said endoluminal implant, said therapeutic transducer supplying energy to a lumen of said endoluminal implant in response to signals from said implantable electronic circuit.

45. The apparatus of claim 44, further comprising an implantable IC sensor physically coupled to said endoluminal implant and electrically coupled to said implantable electronic circuit.

46. The apparatus of claim 45, wherein said implantable IC sensor provides electrical signals to said implantable electronic circuit that are indicative of a diagnostic parameter associated with a fluid flowing through said lumen, wherein said diagnostic parameter is chosen from a group comprising: fluid flow, pressure, temperature and biochemical information.

47. A method comprising:

coupling, via a magnetic signal, a signal to a therapeutic transducer contained in an endoluminal implant; and

activating said therapeutic transducer in response to said magnetic signal.

48. The method of claim 47 wherein activating said therapeutic transducer includes ultrasonically activating a drug.

49. The method of claim 47 wherein activating said therapeutic transducer includes rupturing delivery vehicles to locally deliver a drug.

50. The method of claim 47, further including:

coupling a diagnostic signal from a diagnostic transducer contained in said endoluminal implant to an implantable electronic circuit that is coupled to said endoluminal implant;

transmitting said diagnostic signal from a RF coupling coil that is electrically coupled to said implantable electronic circuit; and

receiving said diagnostic signal at a location outside of a patient's body within which said endoluminal implant is implanted.

51. The method of claim 50 wherein activating said therapeutic transducer includes activating said therapeutic transducer in response to said diagnostic signal.

52. The method of claim 47 wherein activating said therapeutic transducer includes activating an ultrasonic transducer to insonify a lumen of said endoluminal implant with a first ultrasonic signal having a first frequency and a second ultrasonic signal having a second frequency.

53. The method of claim 47 wherein activating said therapeutic transducer includes activating an ultrasonic transducer to insonify a lumen of said endoluminal implant with a first ultrasonic signal having a first frequency and a second ultrasonic signal having a second frequency, wherein said first and second ultrasonic signals are collinear.

54. The method of claim 47 wherein activating said therapeutic transducer includes activating a light source.

55. The method of claim 47 wherein activating said therapeutic transducer includes activating an iontophoretic transducer.

56. The method of claim 47 wherein activating said therapeutic transducer includes activating an electromagnetic transducer.

57. A method comprising:

receiving, at a location outside a patient's body, a diagnostic signal from a diagnostic transducer coupled to an endoluminal implant disposed within a patient's body;

transmitting, from said location outside said patient's body, a therapeutic signal in response to receiving said diagnostic signal; and

activating a therapeutic transducer that is coupled to said endoluminal implant in response to said therapeutic signal.

58. The method of claim 57 wherein receiving a diagnostic signal includes receiving a diagnostic signal describing fluid flow through a lumen of said endoluminal implant.

59. The method of claim 58 wherein activating a therapeutic transducer includes providing, within said lumen, energy for activating a drug precursor.

60. The method of claim 57, further comprising:

transmitting, from said location outside said patient's body, a power signal for providing electrical power to implantable electronic circuitry coupled to said endoluminal implant; and

receiving said power signal by a RF coupling coil disposed within said patient's body and electrically coupled to said implantable electronic circuitry.

61. The method of claim 57, further comprising transmitting, from said location outside said patient's body, a power signal via a hardwired connection extending from said location outside said patient's body to said implantable electronic circuitry, said power signal for providing electrical power to implantable electronic circuitry coupled to said endoluminal implant.

62. The method of claim 60 wherein:

receiving a diagnostic signal includes receiving a diagnostic signal at a first frequency;

transmitting a therapeutic signal includes transmitting a therapeutic signal at said first frequency; and

receiving a power signal includes receiving a power signal at a second frequency different than said first frequency.

63. The method of claim 57 wherein receiving a diagnostic signal includes:

receiving a first diagnostic signal describing fluid pressure at a first end of a lumen of said endoluminal implant; and

receiving a second diagnostic signal describing fluid pressure at a second end of said lumen of said endoluminal implant.